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A STUDY OF SPOTTED OWL HOME-RANGE SIZE AND COMPOSITION IN THE SIERRA NATIONAL FOREST

By

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INTRODUCTION

This report summarizes key activities and results of field studies of spotted owls in the Sierra National Forest during 1987. Initiation of field work was delayed longer than hoped because of funding uncertainties, delays in obtaining clearance on radio-transmitter frequencies, and hiring of experienced field crews. Studies of this sort will continue for at least 4 more years, contingent upon funding. However, the location of the field work may be shifted to the northern portion of the Sierra National Forest for the final 2 years.

Objectives

The principle objectives of the spotted owl research being done by the Pacific Southwest Forest and Range Experiment Station (PSW) work unit at Fresno are to:

1. Determine the sizes and extent of overlap of home ranges of pairs of radio-tagged spotted owls during the breeding season, and characterize the structure and composition of the vegetation included within their home ranges.
2. Determine the timing and extent of altitudinal migration exhibited by radio-tagged spotted owls.
3. Determine the sizes and extent of overlap of home ranges of individual spotted owls during the nonbreeding period, and characterize the structure and composition of the vegetation included within the home ranges.
4. Determine breeding activity, monitor breeding success, and color-band all offspring produced.
5. Document sources of mortality among spotted owls.
6. Characterize diets from collections of cast pellets.

Study Area

The study area is located about 72 km (45 miles) northeast of Fresno, California, within the Sierra National Forest, in the watershed of the North Fork of the Kings River. Vegetation at the lower elevational limit of the summer ranges of spotted owls radio-tagged in this study is dominated by Ponderosa pine (*Pinus ponderosa*); at the upper limit, it is dominated by white fir (*Abies concolor*) and red fir (*A. mangnifica*). Much of the area was logged between 1880 and 1930 and much of the old-growth coniferous forest is in remnant stands. Timber harvest has continued on both private and National Forest lands since that period, but at a reduced rate. Active regeneration programs have been in place in recent years on these lands.

Areas to the south and west of the summer ranges that may be used by spotted owls during the winter range in elevation from 300 to 1000 m and are dominated by blue oak (*Quercus Douglasii*), igger pine (*Pinus sabiniana*), and various foothill chaparral species.

METHODS

Insofar as possible, owl pairs were captured, and these were restricted to a cluster of birds thought to have adjacent home ranges, so the extent of overlap could be determined. This also provided us with the opportunity to study interactions between pairs of birds.

Capture

Thirteen birds were captured and equipped with transmitters and leg bands between 19 April and 11 August 1987. All birds were located by calling.

Twelve were captured by mousing them to the ground and catching them with a fish-landing net. The remaining bird was captured with a noose pole. No injuries to birds or capture personnel occurred during this operation.

Radio locating birds

The transmitters used on all birds in 1987 were Telonics Model 70*, weighing 22 g. Backpack attachment materials added another 4 g, for a total of 26 g. Receivers were Telonics Model TR-2 and TR-2 with Model TS-1 scanners attached. Vehicles were equipped with 1/4-wave-length, roof-mounted, whip antennae for omni-directional searches. Directions to birds were determined using Telonics RA-2, two-element, Adcock hand-held antennae and Suunto KB-14-360R, hand held compasses. If a bird could not be located by normal ground search methods, an airplane was used to search for the transmitter signal.

After a bird was captured and radio-located a few times, and the extent of its home range was estimated, 40 to 50 semi-permanent triangulation stations were located and marked on the ground at selected, convenient locations within home ranges and along their perimeters. Each triangulation station was precisely located on small field maps and on large-scale (1:24,000) topgraphic maps with the universal transverse mercator (UTM) grid drawn on them.

Whenever possible, triangulations were made simultaneously by two observers using two stations. When only one observer was available they had to move quickly from one station to another to reduce the chance of bird movement between observations. Vectors to the bird from at least three stations were taken before the location was recorded. If the three vectors did not cross within 100 m, radio vectors were taken from additional stations until three crossed within the 100-m limit. The bird is recorded as being located in the center of the polygon formed by all vectors. If any other factor, such as excessive time between vectors, signal strength, or unusual habitat of a location lead the observer to question the vectors, more were taken from the same and additional points until the observer was satisfied with the accuracy of the bird's indicated location.

Determination of habitat used requires more precise radio-locating of birds location than determining the boundries of the seasonal home range. Therefore, after each radio-location, the observer estimated the accuracy of the location based on radio signal and size of the vector-formed error polygon (the area enclosed by three intersecting vectors). This was used to classify locations as (1) valid for determining habitat use and home range boundaries; or (2) useful only for delineating home-range boundaries.

For each observation, the bird, date, time, weather, and all triangulation points and vectors, were recorded on a preprinted 5 x 8 inch field form. Each week's forms were delivered to the Fresno Laboratory, where the data were entered into the Data General computer terminal via a custom format using screen prompts and some simple error-check routines. Data were then plotted and examined for suspicious bird locations. When questionable locations were found, the field forms were examined to determine whether a recording error could be identified. If the problem could not be resolved, the cards were returned to the field and discussed with the person(s) making the observation. The problem could usually be resolved this way.

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* Mention of trade names is for information only and is not an endorsement of any product by the government.

Errors in radio-locations were estimated at 100 observations by visually locating birds immediately after estimating their locations from radio signals. Distances between the actual and estimated locations were then measured.

Diet

The diets of spotted owls in the Sierra National Forest will be determined from examination of cast pellets collected as time permits. Roost and nest areas were cleaned of old pellets, and pellets were collected each time an observer was in the area throughout the season. Pellets were bagged and labeled with the date of collection and number of the bird or pair of birds using the area. Samples have not yet been analyzed to determine the prey species comprising owl diets in our sample.

Habitat descriptions

Using seasonal home-range boundaries delineated according to the minimum convex polygon model, a vegetation type matrix within each home range will be mapped on large scale aerial photos, delineating each type polygon. Ground checking will be done as needed. This work remains to be done for the 1987 breeding season data.

Data processing and analysis

Once each week, as new field data are entered into the computer, all spotted owl radio locations are plotted and printed using Data General equipment, laser printer, and a modified 2-D Plot program. The computer draws the minimum convex polygon boundary of each bird's home range and calculates the area. This is all the data processing that is being done at this time.

Differences in home range size will be examined using a 3-way analysis of variance, probably using years, seasons, and sex as the main effects. Habitat type availability and use will be compared to determine preference using chi-square tests.

RESULTS

Capture

Seven pairs of spotted owls were located within an area of 5 by 8 km, in an area ranging in elevation from 1300 to 2400 m. Thirteen of the 14 birds were captured and 12 were equipped with radio transmitters. All birds appeared healthy and normal, although all but one had large numbers of external parasites, mostly hypoboscid flies. Birds have been referred to according to the general areas in which they were initially captured--Dinkey males and female, Stevenson male and female, Markwood male and female, Providence male and female, Exchequer male and female, Laurel Creek male, and Strawberry male.

Breeding activity

None of the birds in our study bred successfully in 1987, although we believe some pairs may have begun nest building. Reasons for nonbreeding were undetermined.

Radio locations

Performance and reliability of receiving equipment has been excellent. The rather heavy (22 gram) Telonics transmitters were a concern to us. However, we have seen no indication that the birds are having trouble carrying them. The performance of these transmitters has been excellent with regular, usable, line-of-sight reception over 8 km (5 miles). Reception over these distances requires good receivers and antennae. One of the 13 transmitters deployed has

failed. Half of our transmitters were equipped with light-weight and half with medium-weight antennae. Both types are subject to damage from preening by the birds, which causes the antenna to form a tight curl over the shoulder, resulting in a somewhat antenuated signal propogation pattern.

By 24 December 1987, we had obtained 1817 radio locations on the original 13 birds, or an average of 140 observations per bird. We obtained at least 100 summer-range locations on nine birds.

Location errors as determined by 101 visual, walk-in observations averaged 147.6 m (s.d. = 135.1 m) with a median of 100 m. Several sources of error contribute to our error estimates, and the error distance was probably much smaller than indicated by the walk-in observations. Most of the walk-in observations were made during daylight hours to reduce the probability of the bird's moving between our determining the location by radio-vector and by visual contact. However, occasional delays in making visual contact with the bird after radio-locating it increased the chance that the bird moved. Some radio-vectors were made from distances as great as 1600 m (1 mile), because access and time were limited.

Our transmitter frequencies were assigned by the Forest Service, Washington Office, per Volume II, Part 5, Subpart C, Section 5.108 of the Federal Communications Commission Regulations set forth in 1975. Therefore, we were assigned Forest Service frequencies between 168 and 171 MHz that were not being used in our area. Some of our assigned frequencies were as close as 0.0125 MHz to those being used by the National Forest communications net in our area. We were, therefore, concerned about problems with interference, both with our operation and with the National Forest's radio net. As yet we have not had problems, and having protected frequencies has minimized "noise" interference.

George Steger visited spotted owl research operations on the Tahoe and Klamath National Forests and at Roseburg, Oregon, to observe and learn techniques that might improve the efficiency of our operation. He found that all three sites were less prone to radio-signal bounce and that all were better roaded, allowing triangulation from much shorter distances. He also found that the simple habitat matrix of the Roseburg study area made predicting the bird's location easier, thereby reducing the time needed to determine each location.

Home-range size

Home-range sizes of all birds continued to increase as long as we continued to get daily locations on them (figs. 1, 2, & 3). Home ranges of nine birds averaged 580 ha on 11 August, 886 ha on 16 September (an increase of 53 percent in only 36 days), and 1198 ha on 30 October (another 35 percent increase in 44 days).

Through August, home ranges of pairs exhibited almost no overlap. However, much of the growth in home-range size that occurred during September, October, and November intruded into home ranges of adjacent pairs.

We compared total home-range size using all observations, only daylight observations, and only nighttime observations. This showed that birds used an average of 93% of their total home range at night and 35% in the day.

Migration

On 16 October, the Stevenson Creek female migrated about 21 km south from her summer range in mixed-conifer forest at 2100 m elevation, to 300 m along the shore of a large reservoir, in the oak-digger pine type (Fig. 4). Since then, she has moved back and forth between this site and a small, steep canyon at 550 m elevation, with a dense stand of oak, sycamore, and buckeye. Another pair of spotted owls was also using this canyon and was once seen about 150 m from the Stevenson Creek female.

The Dinkey Creek female left her summer home range in mixed-conifer forest

on 14 November and migrated about 17 km south, down the same drainage as the Stevenson Creek female, and spent a week at 500 to 550 m (Fig. 5). About 21 November, she moved 11 km southeast, across a 1600-m ridge into the next major drainage to another oak, pine, chaparral type at 500 m. A few day later she moved across a large reservoir and another high ridge (about 12 km) for a total migration of about 40 km. She died in this location (see below under "mortalities").

On 17 December, Dinkey male #2 (see below under "mortalities") migrated to the same area as that being used by the Stevenson female (Fig. 6); the two birds have been seen within 50 m of each other on several occasions.

No other bird had migrated from the general area of their summer home range by 31 December 1987, in spite of the fact that several storms had passed through the area and much snow had fallen.

Mortalities

Dinkey male #1 died on the summer range, 40 days after being captured, possibly killed by an avaian predator. This bird's mate located and paired with another male (Dinkey male #2) within 7 days. The Dinkey female died on the winter range, 230 days after being captured. It had taken a long and circuitous route to the winter range and weighed 20% less than when captured. The necropsy report from the California Department of Fish and Game Laboratory in Rancho Cordova concluded that the bird most likely died of starvation. The report also raised a concern about the possibility that feather wear and skin exposure under the radio transmitter had contributed to increased energy drain on the bird.

Diet

We collected 301 pellets from six roost areas during the summer. Plans to have the pellet contents identified have not yet been developed.

Habitat description

No habitat description or mapping work has been completed as yet. Large scale aerial photos and orthoquad aerial photo mosaic maps are available for type mapping of the summer range and will be purchased for the winter range as the areas used by the birds are identified.

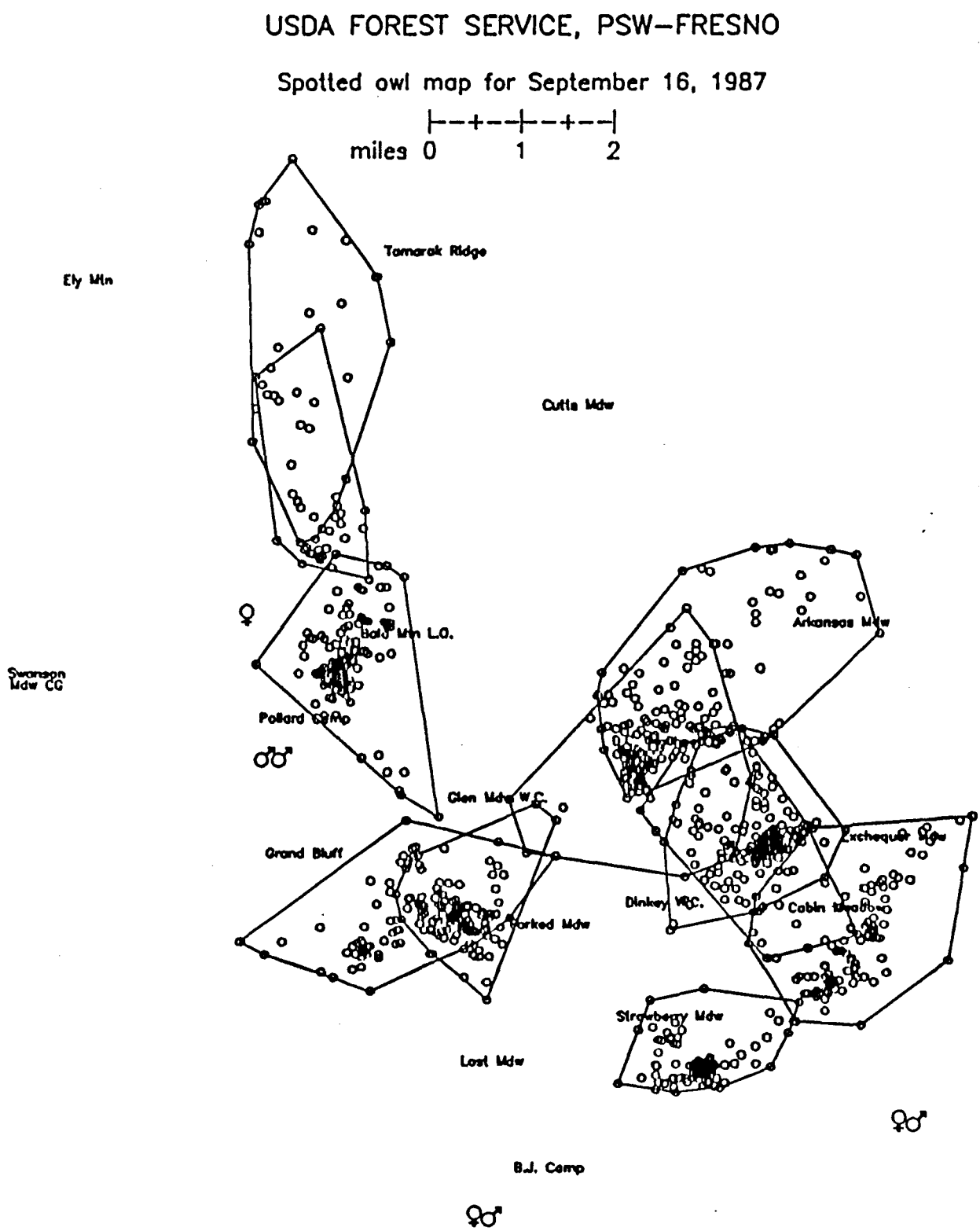

USDA FOREST SERVICE, PSW–FRESNO
Spotted owl map for September 16, 1987
miles 0 1 2
Ely Mtn
Tamarak Ridge
Cutis Mdw
Swanson Mdw CG
Bald Mtn L.O.
Pollard Camp
Glen Mdw W.C.
Grand Bluff
Arkansas Mdw
Exchequer Mdw
Dinkey W.C.
Cabin Meadow
Forked Mdw
Strawberry Mdw
Lost Mdw
B.J. Camp

FIGURE 1

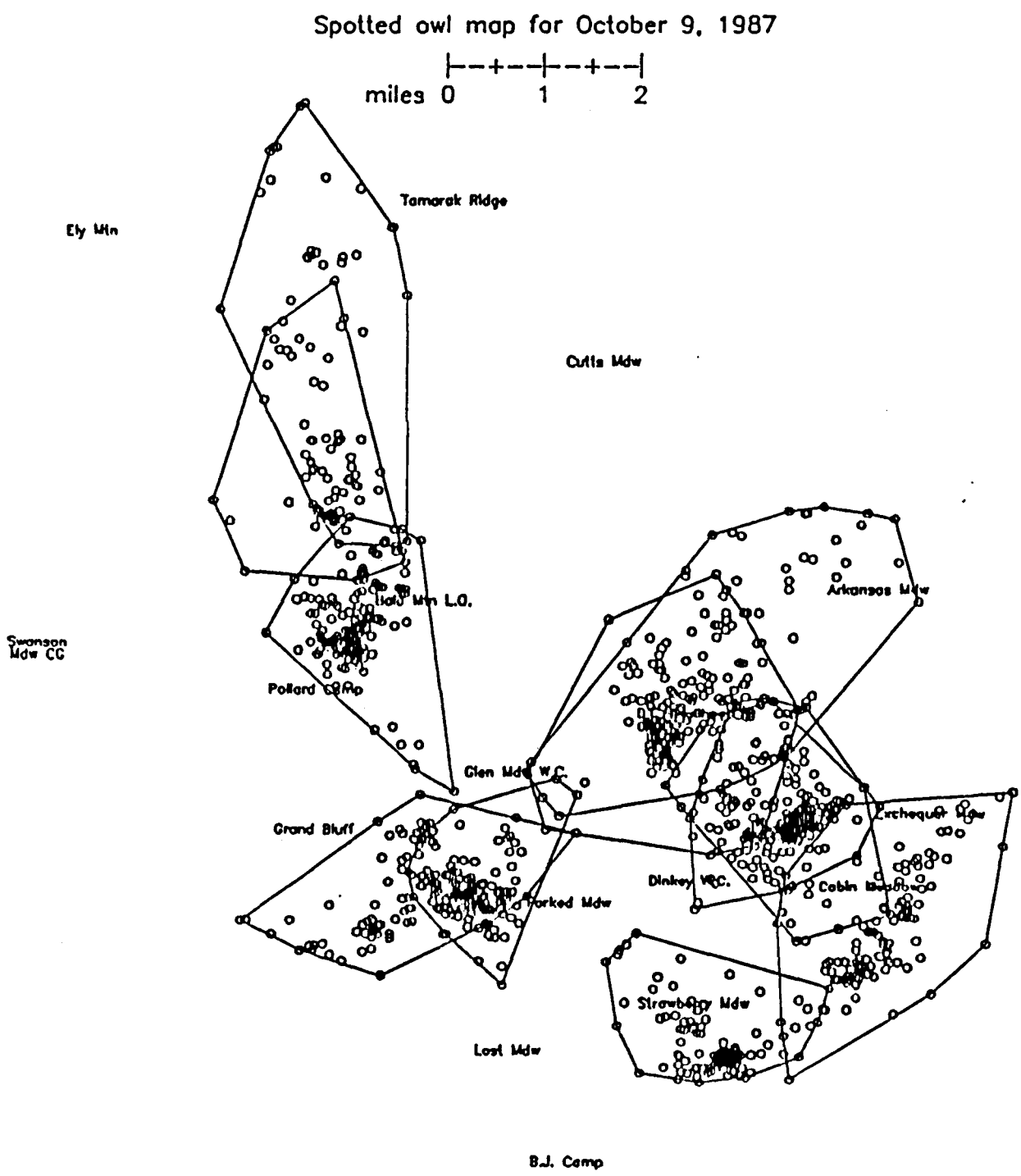

USDA FOREST SERVICE, PSW–FRESNO
Spotted owl map for October 9, 1987
miles 0 1 2
Tamarak Ridge
Ely Mtn
Cutts Mdw
Arkansas Mdw
Swanson Mdw CG
Pollard Camp
Glen Mdw W.C.
Grand Bluff
Dinkey W.C.
Cabin
Strawberry Mdw
Lost Mdw
B.J. Camp

FIGURE 2

USDA FOREST SERVICE, PSW–FRESNO

Spotted owl map for DECEMBER 10, 1987

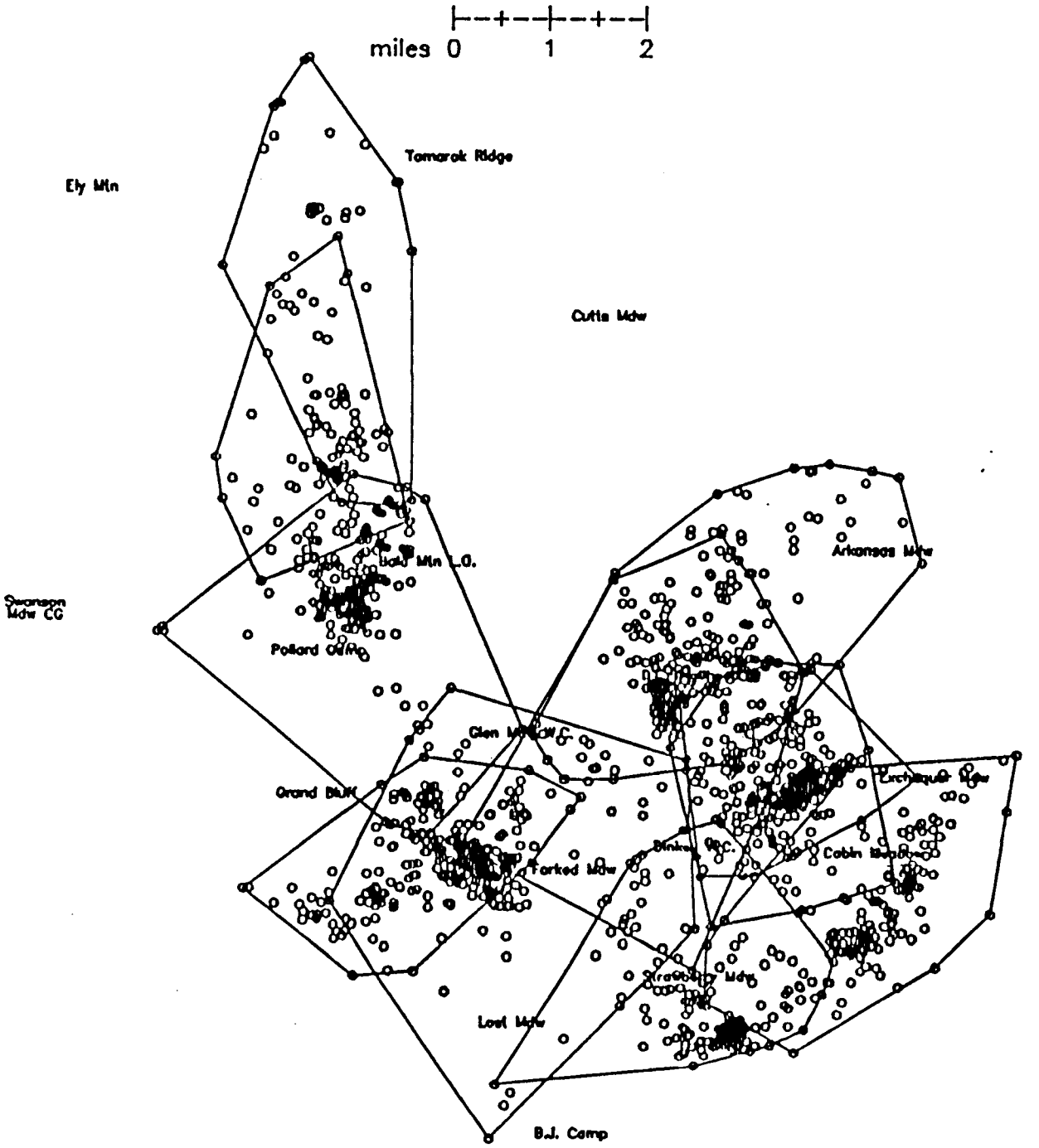
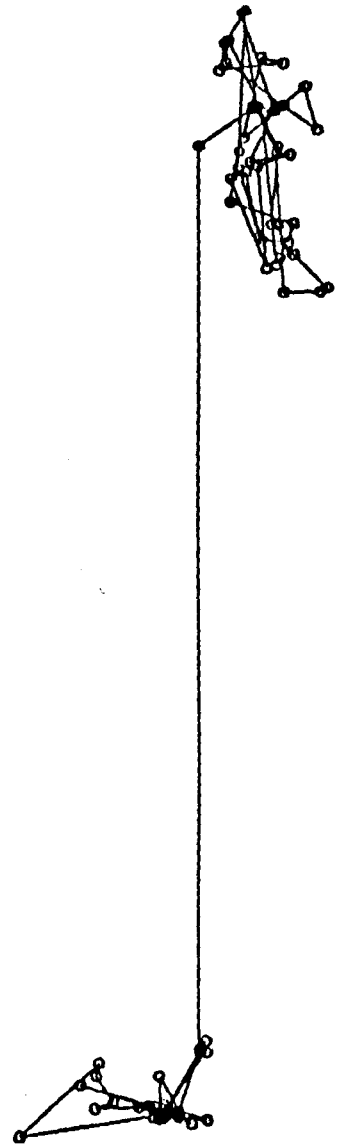
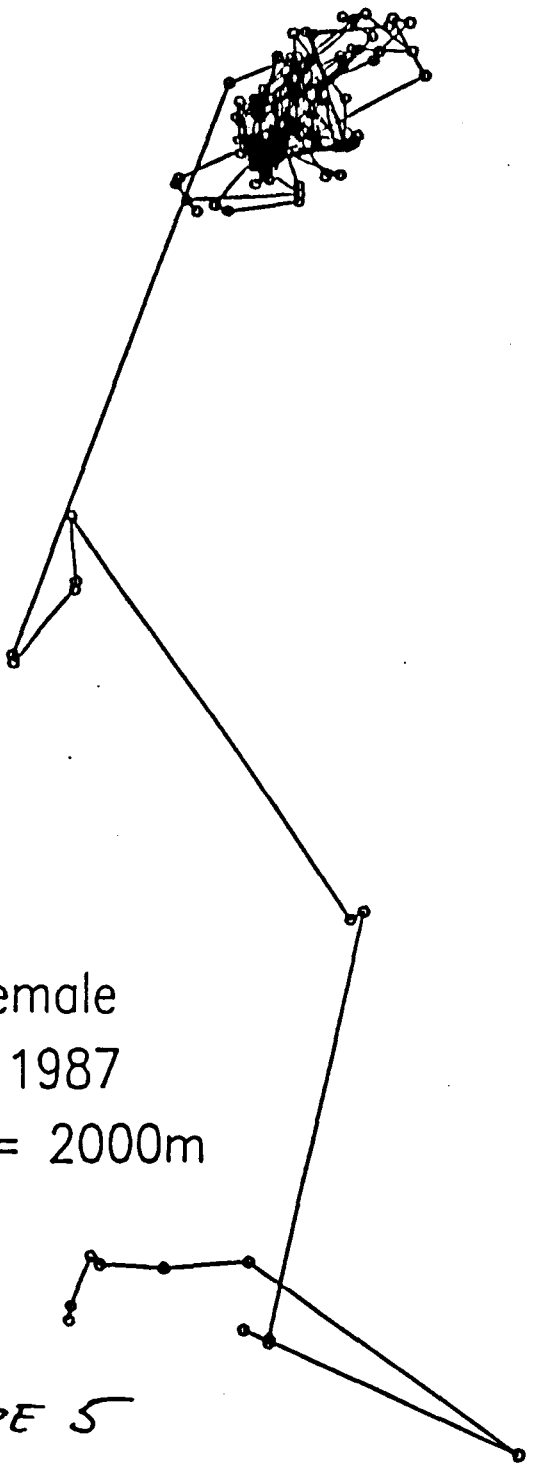


FIGURE 3



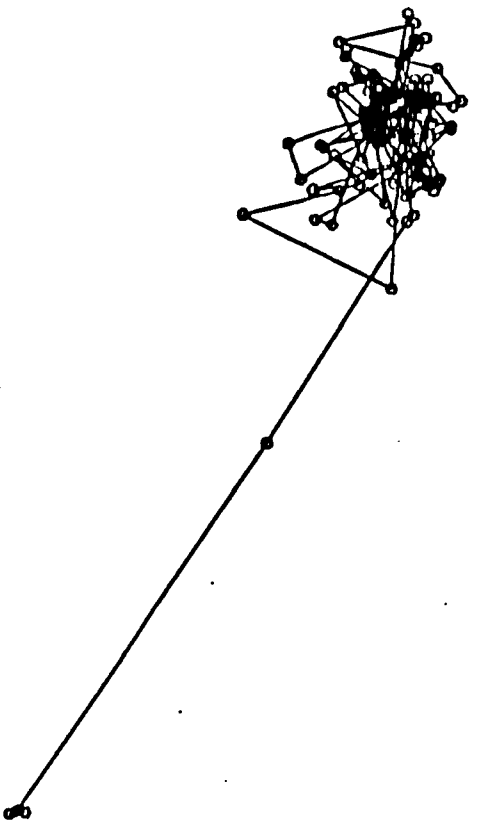
Stevenson Female
Dec. 24, 1987
Scale: 1cm = 2000m

FIGURE 4



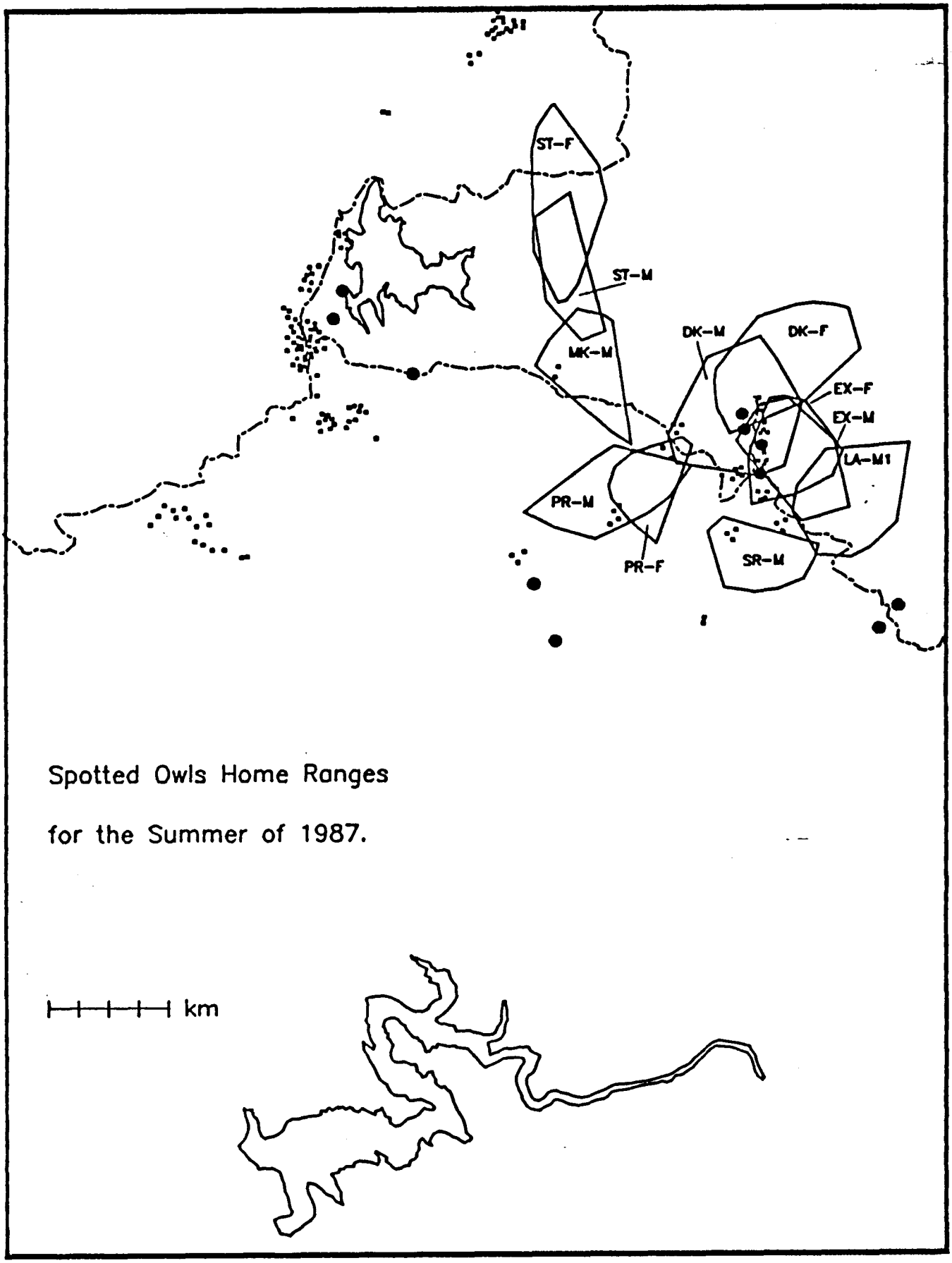
Dinkey Female
Dec. 24, 1987
Scale: 1cm = 2000m

FIGURE 5



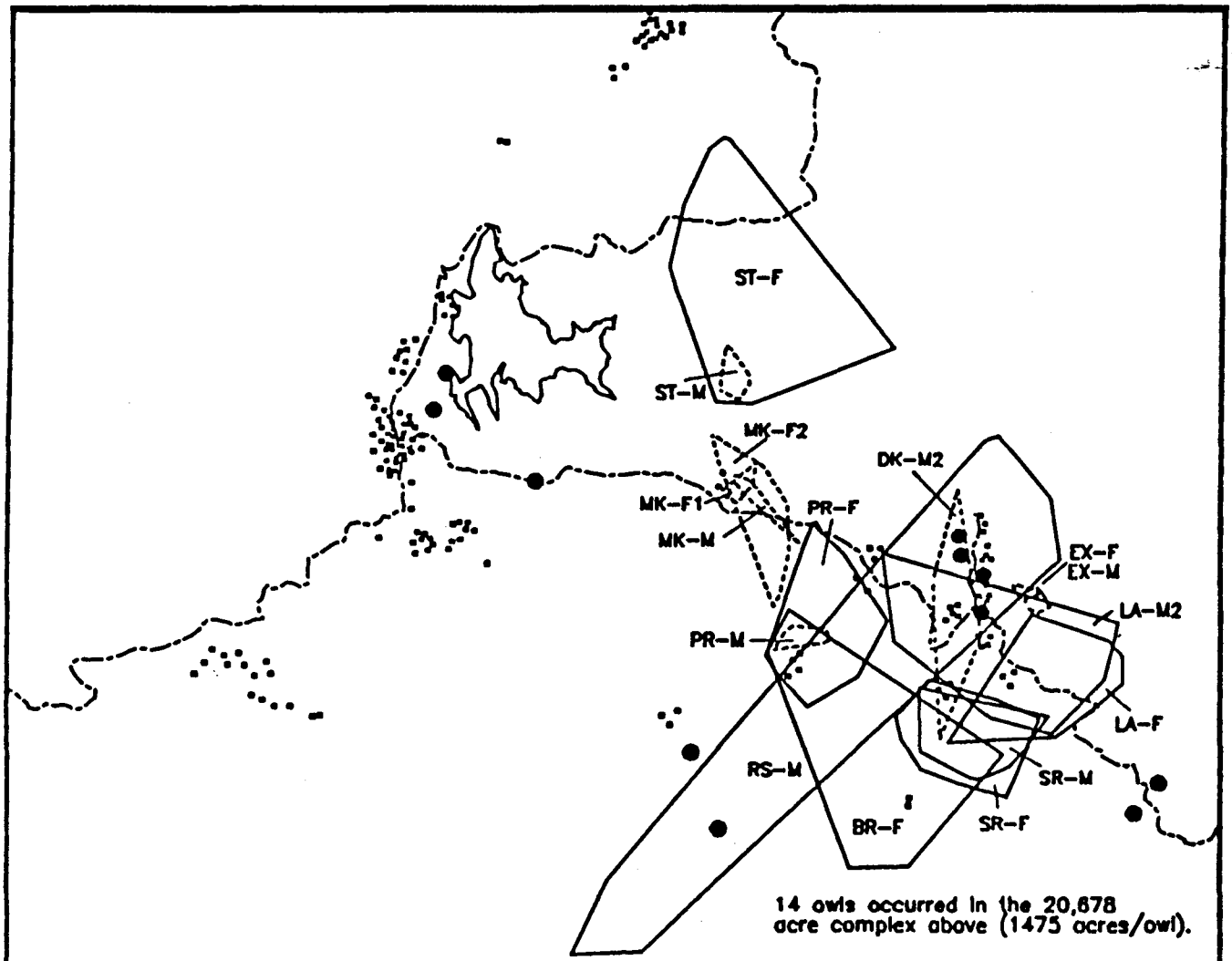
Dinkey Male
Dec. 24, 1987
Scale: 1cm = 2000m

FIGURE 6



Spotted Owls Home Ranges

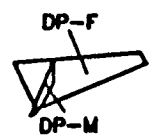
for the Summer of 1987.

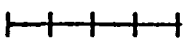


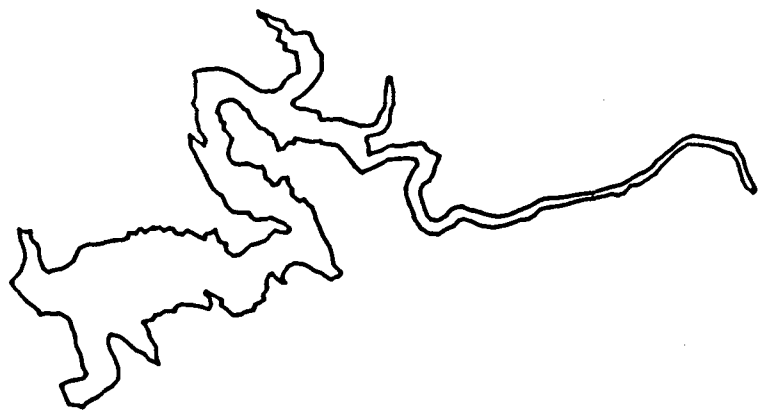
Spotted Owl Home Ranges

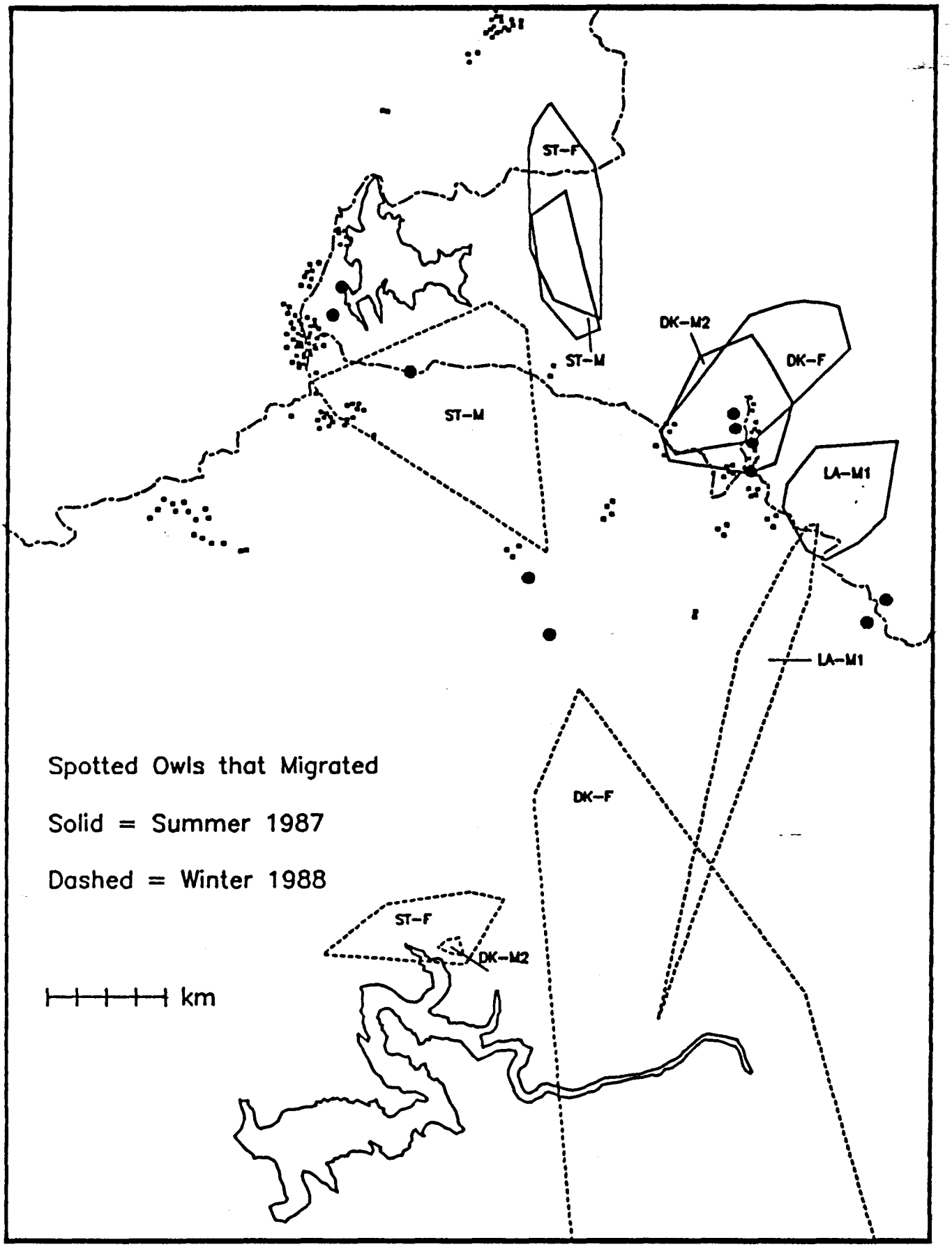
for the Summer of 1988.

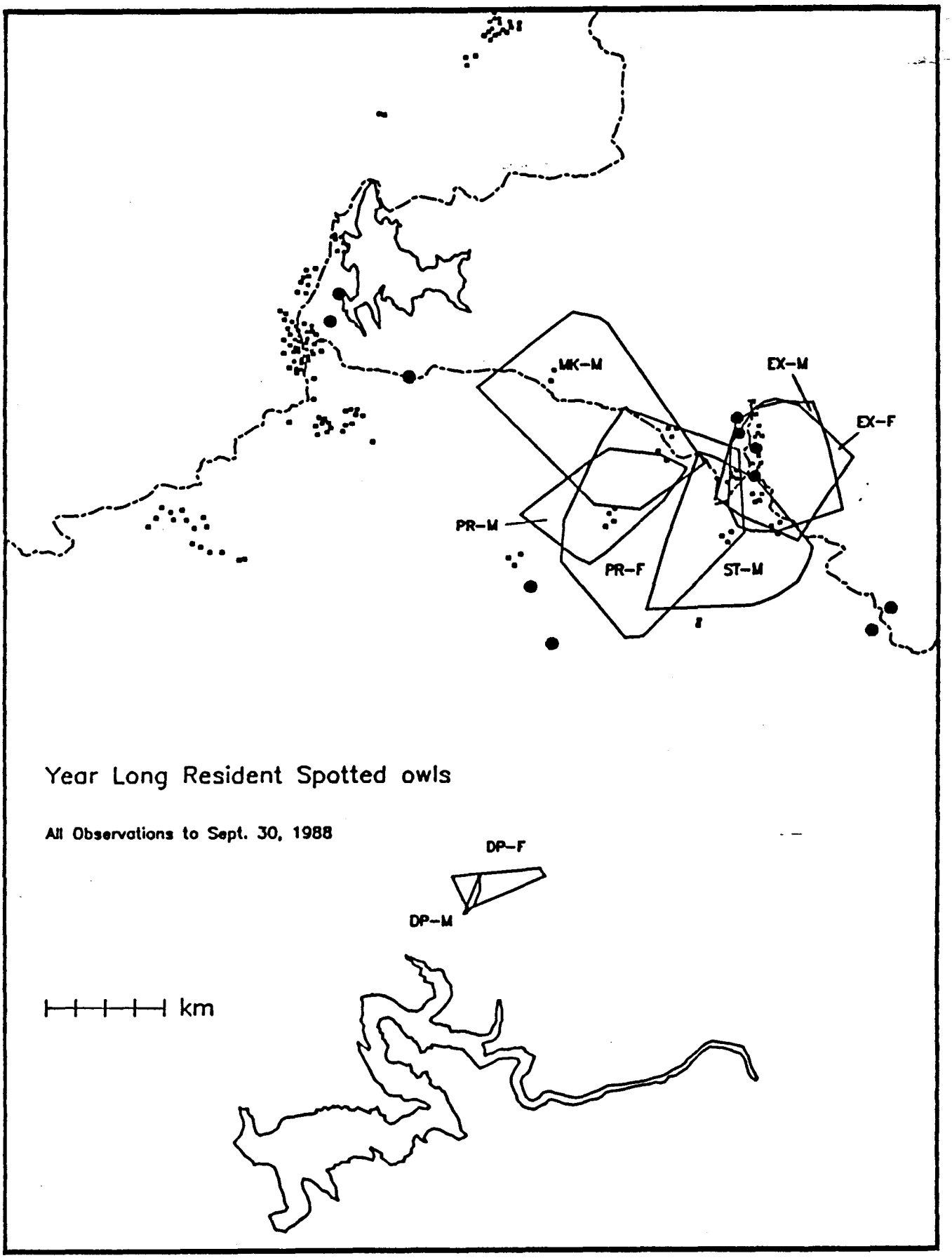
Dashed lines indicate incomplete data.








ST-F
DK-M2
DK-F
ST-M
ST-M
LA-M1
LA-M1
DK-F
Spotted Owls that Migrated
Solid = Summer 1987
Dashed = Winter 1988
ST-F
DK-M2
km



Year Long Resident Spotted owls

All Observations to Sept. 30, 1988

Key	Owl Name	Sex	Date Caught	Date Lost		Remarks	Migration Status
BR-M	Bearcreek	M-1	-----		Live	Not captured	--------
BR-F	Bearcreek	F-1	88172		Live	Active	--------
DP-M	Deepcreek	M-1	88033		Live	Active	Resident
DP-F	Deepcreek	F-1	88118	88224	Live	Radio failed	Resident
DP-?	Deepcreek	?-?	-----		Live	Not captured	--------
DK-M1	Dinkey	M-1	87124	87164	Died		--------
DK-M2	Dinkey	M-2	87165	88133	Died		Migrated
DK-F	Dinkey	F-1	87119	87349	Died		Migrated
EX-M	Exchequer	M-1	87160	88063	Live	Radio failed	Resident
EX-F	Exchequer	F-1	87155	88077	Live	Radio failed	Resident
LA-M1	Laurel	M-1	87167	88026	Died		Migrated
LA-M2	Laurel	M-2	88098		Live	Active	--------
LA-F	Laurel	F-1	88124	88251	Live	Radio failed	--------
MK-M	Markwood	M-1	87126	88067	Live	Radio failed	Resident
MK-F1	Markwood	F-1	87126	88134	Died		Unknown
MK-F2	Markwood	F-2	88221		Live	Active	--------
PR-M	Providence	M-1	87155	88095	Live	Radio failed	Resident
PR-F	Providence	F-1	87155		Live	Active	Resident
RS-M	Reesecreek	M-1	88103		Live	Active	--------
RS-F	Reesecreek	F-1	-----		Live	Not captured	--------
ST-M	Stevenson	M-1	87223	88140	Live	Radio failed	Migrated
ST-F	Stevenson	F-1	87223		Live	Active	Migrated
SR-M	Strawberry	M-1	87168	88252	Live	Radio failed	Resident
SR-F	Strawberry	F-1	88109		Live	Active	--------